

Accelerator Systems Division Highlights Ending February 20, 2004

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) *402.5-MHz, 2.5-MW E2V klystrons*: The factory acceptance tests for SN 7 have been delayed to March 24-26. (2) *805-MHz, 5-MW Thales klystrons*: This week we finished conditioning SN 1 to full voltage and full RF power. We began the heat run, but progress has been delayed due to problems with the production HVCM. We plan to switch over to the prototype HVCM and resume testing by the end of the week. We are testing 24 hours a day during the week to make up for the lost test time. The next 5-MW klystron is scheduled for factory acceptance tests the week of Feb 23. (3) *805-MHz, 550-kW Thales klystrons*: SN 10 and SN 11 passed factory acceptance tests. Three klystrons are now in transit between Thales and LANL. One klystron remains at Thales and four are at LANL awaiting tests. (4) *805-MHz, 550-kW CPI klystrons*: The test data for SN 48 has been approved by LANL. SN 48 and SN 49 have completed the factory acceptance tests, but the data have not yet been sent to LANL for approval. SN 50 is under test. SN 48, SN 49 and SN 50 are scheduled to ship to ORNL on Feb 27. (5) *805-MHz, 5-MW AFT circulators*: We have scheduled the site acceptance testing for circulators on Feb 26-27 and Mar 1-2. We are expecting a detailed high-power testing manual next week from AFT. We plan to do these tests without an AFT rep at LANL. If we encounter problems, AFT has agreed to come to LANL on short notice.

Concerns & Actions: The HVCM problems have delayed testing of the 5-MW klystrons to full power, and there is concern that the installation and commissioning schedule at ORNL may be impacted. After discussions with the ORNL RF-power group, we propose that LANL tests the existing klystron to 4 MW at 30 Hz so it could be delivered to ORNL. We would then try again with the 3rd klystron to test to full power. Part of the reason for this is that Thales is going to change the SF6 barrier window to a material that may be more susceptible to thermal problems, so it will be important to test this at high power in case there is a fundamental design issue with this change. If the HVCM problems persist and the installation schedule demands, however, we can also reduce the testing requirement on the 3rd tube.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Concerns & Actions: (1) We are working with the production HVCM to determine the cause of modulator OV trips or IGBT over current trips. This production HVCM has never been able to operate at high power or above 125 kV without tripping off. We sent the production IGBT controller to Z-Tec to determine if internal DSP or faulty electronics were causing the spurious trips. However, the unit completely passes all testing at Z-Tec. In the meantime, we used the "first lot" IGBT controller (with lower fiber-optic power output) to resume tests. We extensively diagnosed the switch plates with Rogowski monitors and differential voltage dividers. No real data were obtained that showed significant or repeatable problems that we could determine. (2) However, upon resumption of operation, the production HVCM blew internally during an overnight heat run on the 5-MW klystron at full power. All IGBT switch plates are visually OK, but the B and C phases were dislodged from the interface headers. The desiccant filter was ejected from the modulator lid, and the oil was badly carbonized. We will examine the internals to try to find the root causes of the failure. We believe one problem might be related to fabrication and another to a defective component. This unit has fabrication techniques that are typical of the first-lot HVCMs build by Dynapower. We hope to resume klystron tests with the prototype HVCM, after the production unit is pulled from the area.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: (1) Drift tube 2-02 was shipped to ORNL on Saturday and arrived on Monday, Feb 16. (2) Drift tube 6-17 was received at CMI and will be final profiled next Tuesday. Following that we will bake and leak check it at LANL before sending it to ORNL by the end of next week. (3) We shipped the final three Tank-2 post couplers to ORNL on Monday, Feb 16. (4) Pete Smith will be at ESCO next week for welding of Tank-4 post couplers.

COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) ASD took delivery of CCL Module-2 at the SNS site on Monday Feb 16; segment installation will begin next week (see photo below). (2) Segment tuning and mounting on the stand continue for CCL Module 3 at ACCEL (3) Replacement of the damaged segment from CCL Module 4 Segment 8 is going well. The plates will be shipped from Erlangen to ACCEL on Friday, Feb 20. They will be cleaned and brazed on Saturday and shipped back to Erlangen for machining next Monday.

PHYSICS & DIAGNOSTICS (WBS 1.4.5)

Accomplishments: (1) *BPM Electronics:* We shipped the complete set of CCL BPM electronics to ORNL. John Power and Matt Stettler are at ORNL this week and next to help with the installation and commissioning of DTL and CCL units. We are receiving electronics boards from Suntron for the SCL and HEBT units and expect to have a complete set of parts and PCs on hand by the end of next week. (2) *BPM pickups:* We shipped two spare CCL-type BPM pickups and a ceramic break for the CM to ORNL this week. (3) *Wire-scanner electronics:* All units have been assembled and are undergoing final tests. They will be shipped to ORNL next week. Wynn Christensen will travel to ORNL the week of March 8 to complete the hand over and help with installation and testing. (4) *Wire-scanner pickups:* This week we shipped four 3-inch (CCL) actuators, all of the forks and their nuts & bolts to ORNL. We are testing two more 3-inch actuators and expecting to receive the last two this week. These final four CCL actuators will be shipped to ORNL next week. We are also anticipating the first units of the 8-inchj and 12-inch actuators next week. LANL technician, Steve Armijo, will travel to ORNL the week of March 8 to help with assembly and installation of the wire-scanner hardware. (5) *RTBT harp:* We have formally placed the SNS harp-card order with Macro-Metallic. The delivery schedule is: sample card for LANL solder testing April 9 and finished cards due at LANL the end of May. Work on the harp strongback, spacers, and insulators is continuing on schedule. Work on the high voltage planes is also on schedule at the Bogue machine shop in Albuquerque. We anticipate this work to be completed by the end of next week. (6) *Harp electronics:* We completed the preliminary design for the electronics board, and we anticipate proceeding to ECAD next week. The expected date for the prototype board is one month from now. (7) *Transition-region beam stop and wire-scanner vacuum box:* The fabrication is proceeding on schedule, and we anticipate a delivery date of end of March. Following a week of checking out and testing they will be shipped to ORNL.

PROJECT MANAGEMENT (WBS 1.4.5)

Accomplishments: (1) Los Alamos SNS Division will disband in 42 days, and we are working with SNS-ORNL on closeout issues. Three of 12 "category-1" files have been novated to date (ACCEL CCL, Dynapower HVCM and Titan NC Transmitters). The remaining nine contracts will be novated by Mar 31. Eighteen of 24 "category-2" files were sent to ORNL on Feb 11 and the remaining six were sent on Feb 18. (2) We sent a tentative list of LANSCE personnel who could come to ORNL to help with commissioning to ASD this week.

ASD/JLAB: Cold Linac**ASD/BNL: Ring****Controls****Installation****Craft Snapshot 2/17/04**

ASD productive craft workers	57.0
Foremen (Pd by 15% OH)	7.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	67.0
Less WBS 1.9, 1.2 etc	6.0
Less absent	3.0
TOTAL PD BY ASD/ORNL DB WPs	48.0

Accelerator Physics

The AP group and Yoon Kang of the RF group held an Open House for UT Physics and Electrical Engineering graduate students. About 17 faculty and students toured the SNS site and met with staff.

Work in preparation for ASAC continues. This includes i) modeling the chicane magnet fields in ORBIT simulation, ii) determination of the tune and betatron phase resolution achievable with single-turn injection, and with single-turn kick of a small accumulated beam, iii) further benchmarking of ORBIT with PSR observations related to linac bunch dynamics in the ring.

D. Jeon and A. Aleksandrov are further analyzing the DTL1 commissioning data in order to understand emittance observations.

A MAD input file for the Ring can now be written from the global database. Comparison with reference lattice files is underway.

The online model for the linac is being extended to handle longitudinal dynamics in the presence of beam or RF phase errors. This involves capturing the transit-time factor tables in the global database.

The ring 21Q quadrupoles are now in the database together with the results of their individual magnetic field maps and their assignments to specific locations in the ring. We are now in a position to generate a database report that will be used as an input to ORBIT to simulate the ring using actual magnetic field measurements. Eventually we will be able to use as-measured magnetic fields for all dipole and quadrupole magnets in the ring, thus improving the realism of the model calculations.

We checked an assortment of steel shielding blocks for excess magnetic fields. These blocks will be used to shield the beam pipe leading from the RTBT to the target. Excessive magnetic fields could deflect the beam from its nominal trajectory between the RTBT and the target. The highest measured field was 2.0 Gauss, which is normal and expected.

Work is underway to prepare for the ASAC review in March.

Operations

Ion Source Group

The ion source has recovered from the multiple failures that shut down the hot spare stand early in the week. While the operation appears to be very efficient with 30 kW 2MHz producing 36 mA average pulse current, 37 sccm Hydrogen and 200 W 13 MHz are required for the plasma not to extinguish from time to time. By the end of the week the ion source has delivered close to 40 mA with a 6% duty cycle for the equivalent of 9 days.

Extensive efforts by ES&H staff and the installation group has made it possible for Martin Stockli to return part-time to work on the site, two weeks after being upgraded with a ceramic hip joint.

Survey and Alignment Group

Survey and Alignment performed the monthly RTBT floor monitoring campaign on Monday 2-16. Additional settlement of 3 mm was measured on the RTBT floor at the RTBT/Target interface. This point is now 5.07 inches below design height.

The remaining field work was completed in the effort to verify that the re-observed Linac network is still properly oriented relative to the as-built target center. Data checking and processing is now underway.

This week, S&A met with the site surveyors to discuss the alignment of the shutter inner and outer guide rails located in the target monolith. Laying out the guide rails with respect to the Knight Jacobs drawings would have put the outer guide rails out of tolerance as a result of the 0.024 degree rotation of the core vessel. The solution will be for S&A to layout adhesive targets on the monolith shelf representing each beam line. From there, the site surveyor can utilize these targets to set out the shutter guide rails.

We will be laying out the new location for the experiment tank for beam line 2TU. The site surveyor has already marked this new tank location out in the 2TU experiment building and we will be verifying this point. From preliminary checks, it looks as though the point marked out using two different methods will have the same results. Furthermore, we will be laying out two reference lines which will facilitate future work on the tank.

With respect to the medium beta cryo modules, we now have in our master data base the necessary data for alignment, when the time comes.

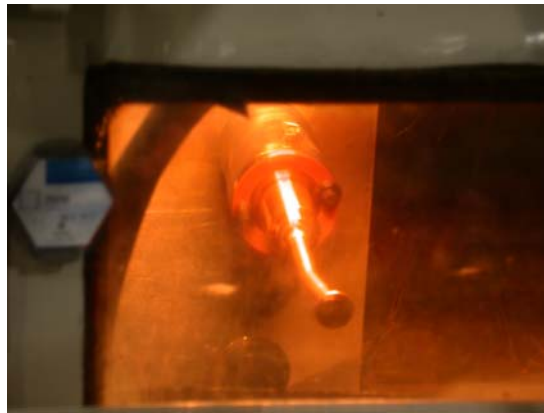
We optically set two 21Q40 magnets, fiducialized one additional 21Q40 (total fiducialized now 11) and two more CCL quad magnets (total now 31).

Preparing necessary coordinates data for the installation of equipment into the upper and lower straight sections of the Ring.

Mechanical Group

DTL 1 leak checking is looking good so far but a thorough check takes time and will continue.

Drift tube 2-02 for DTL 2 has been returned to ORNL. The initial leak test looked good and it is undergoing a 24 hour bake. The post couplers have arrived and been flow tested. We will commence with final prep and installation of them. This photo is of a post coupler mounted in the electron beam welder at ESCO.

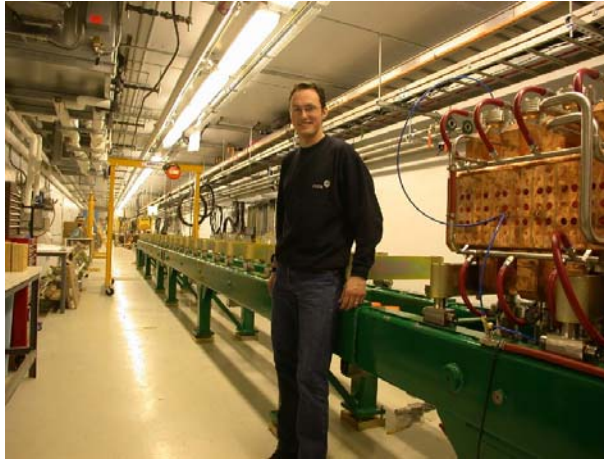


After making adjustments to 3 of the post couplers in DTL 3 to compensate for some tuning variations, this tank has been declared as ready

After running into a few difficulties with DTL 5 we are now ready to resume processing this tank by doing a quick alignment followed by tuning.

Diagnostic for DTL 1-3 cabling is being prepared terminated in preparation for final installation of Faraday cups, beam current monitors, and wire scanners.

CCL-2 components were received at the SNS site on Monday afternoon (Feb. 16). Daniel Trompetter from ACCEL inspected the components after unloading and all components looked ok. The support frames have been set on the beam line and leveled. Segment installation will begin next week.



Daniel Trompetter from ACCEL with CCL-2 Support Frame

Water Systems Installation

- Installation of DI water piping on SCL ME-03 continued.
- Installation of DI water piping on SCL ME-04 continued.
- Installation of DI water piping to CCL1 module continued.
- Fabrication and installation of the QMCS manifold continued.

Ring Systems Installation

- The RING Half-Cell #22 was received and staged in the tunnel.
- The support pads for Arc C Half-Cells were grouted and baseplate installation started.
- Installation of PPS system conduit continued in the HEBT,
- The Linac Dump beamline was leak tested and initial pump down started.

Magnet Task

Electrical Group

DTL modulators ME1 and ME2 have been retrofitted with the latest upgrades in pulse transformer cooling and IGBT heat sinks. Both modulators have been re-assembled and are ready for testing next week. DTL modulator ME3 is currently having these upgrades applied. CCL modulator ME-3 is undergoing check out.

Five medium Ring HEBT and RTBT power supplies (185A and 390A) power supplies have been delivered from the vendor, bringing the total number of medium supplies delivered to 12 (of 69). One of the 185A power supplies is undergoing testing on the test stand.

The first production injection kicker power supply has been delivered. Enclosed is a photo of the injection kicker supply.

Roy Cutler and Ken Rust visited Brookhaven National Laboratory this week and observed the first production extraction kicker magnet power supply tests. The tests went extremely well and the power supply easily meets all requirements.



HPRF

LLRF

The first-article inspection of the High-Power Protection Module (HPM) and Field Control Module (FCM) printed circuit boards (4 boards) was performed at Suntron in Phoenix, AZ, on Feb. 13. These boards were received at ORNL on Feb. 16 and passed the first round of acceptance tests in the lab. The remainder of the Phase I production (20 sets) is due for completion Feb. 27.

The first shipment of Analog Front End (AFE) printed circuit boards was received at ORNL on Feb. 12. These boards will undergo acceptance testing next week prior to the vendor being given approval to proceed with the production. One of the new AFEs was assembled to the new FCM boards from Suntron, thereby completing the first production FCM, which is presently running in the lab.

The first articles of the FCM coaxial cable sets were received this week. They passed incoming inspection and testing, and the vendor has been authorized to proceed with the balance of the order.

The first-article dual-channel downconversion chassis for the SCL passed incoming inspection and testing. The vendor has been authorized to proceed with fabrication of the balance of the order.

The 805 MHz reference line shipped and is expected to arrive at ORNL next week. Installation of the 755 MHz local oscillator distribution network is in progress in the klystron gallery.

The FCM test at JLab, scheduled for next week, has been postponed due to the failure of the 1 MW RF system.

Hengjie Ma completed a Verilog course in San Jose and spent two days working with Larry Doolittle at LBNL on the FCM FPGA code.

Cryosystem Group

The current transformers (CT) for motor #4 compressor have been replaced and the motor operated successfully without the compressor load. Monday we will install the coupler to the compressor and attempt to start the motor.

The oil pressure regulating valve for compressor #6 has been assembled and we will run the compressor to remove the H₂O some time next week. Compressors # 1, 2, 3, & 5 have been dehydrated and are ready for operation.

The oil processor has been set in place and connected electrically. We have leak checked the system and repaired several small vacuum leaks. The processor will be filled with oil and operated next week.

Work continues to install the instrument tubing on the warm gas header.

We have started to assemble the transfer lines for the 4.5K cold box test.

Beam Diagnostics